SHIPBOARD INFECTION CONTROL

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OVERVIEW

- Defining shipboard infection control
- USNS Comfort – A Hospital Ship at war (OIF).
- OIF Injuries
- An outbreak
- Control strategies

DEFINING SHIPBOARD INFECTION CONTROL

- Preventing environment-associated infections and disease transmission on a shipboard health care facilities.

INFECTION CONTROL

- Hospital (MTF)
  - Multi Drug Resistant Bugs
  - Nosocomial Infections (Hospital related)
  - Community Associated infections brought in
  - Immunocompromised pts
  - TB/HIV
- Hospital ship (USNS Comfort)
  - SAME ISSUES
  - **CHALLENGES**
    - More confined environment
    - Limited resources
    - Ventilation Issues
    - Water safety issues
    - More significant in War-time setting
    - Global Health Threats

PURPOSE OF ANY INFECTION CONTROL PROGRAM

- Prevent disease transmission
- Minimize morbidity
- Prevent mortality
- Decrease Hospital length Stay
- Prevent illness among health care workers
- Decrease the probability of new emergent infections or resistant strains.

ENVIRONMENTAL Factors Associated with disease transmission

- AIR (Droplet)
- Water
- Environment (Surface)

Navy Shipboard IC: Unique Situation

- Battlefield injuries (Unsanitary conditions)
  - Limited resources/ promptness of care
- Global Health Issues
  - Mega cities with severe health care deficiencies
  - Cross-border movement facilitate disease spread
  - Drug resistant Microbes
    - Wide Spread use of Antibiotic
- Unknown

INFECTIONS in Military Field Medicine

- Types of wound infections
  - WWI- Anaerobes 23% gangrene 3-5%
  - WWII *45% anaerobes, 16% Strep 6% Staph 12% GNR*
  - Korea 36-84% *Clostridia*, 21-25% *Strep* 16-45 % *Staph (some* PCN R), 6-21% GNRs
  - Vietnam-GNRs *Pseudomonas, E coli, Enterobacter;* ~30% infection rate
- Incidence depend on location and medical technology capabilities

OPERATION IRAQI FREEDOM

- USNS Comfort at war
  - 25mi off Iraq coast
- Tertiary care center
  - Comparable to a major MTF
- 800 outpatient visits
- 360 admissions
- 215 wounded in action (Coalition, Iraqi civilian, EPW)

MAJOR INFECTIOUS THREATS

- Bio-terrorism Agents (Smallpox, anthrax, Plague...)
- Tuberculosis
- Viral (Norwalk-like Virus) and Bacterial gastroenteritis, Food/water illness, URI
- Re-emerging Infectious Disease

ACTIVE SHIPBOARD INFECTION CONTROL PROGRAMS

- Preventive medicine programs - Inspections
  - Food/Water/Air Quality/Environment
- Disease surveillance
  - Sick Call
  - Ships ER
- Disease related investigations
- Needle Stick Program

USNS Comfort Isolation Rooms

- Air-droplet precautions
- Independent Air vent system
- Negative pressure room

Isolation Ward

- 20 ICU Bed
- Three independent sections

How patients arrived onto the USNS Comfort

- Infection Control begins
  - Patients Flown-in
    - Patched-up in the field prior to arrival
    - Most were delayed arrival

Carried in

Decontamination

Before opening this door, ensure there is no patient in the next compartment and the opposite door is closed.
Before opening t
is no patient in
and the opposite

Triaged

Processed Through

EVALUATED

Stabilized

Specialty Services Provided

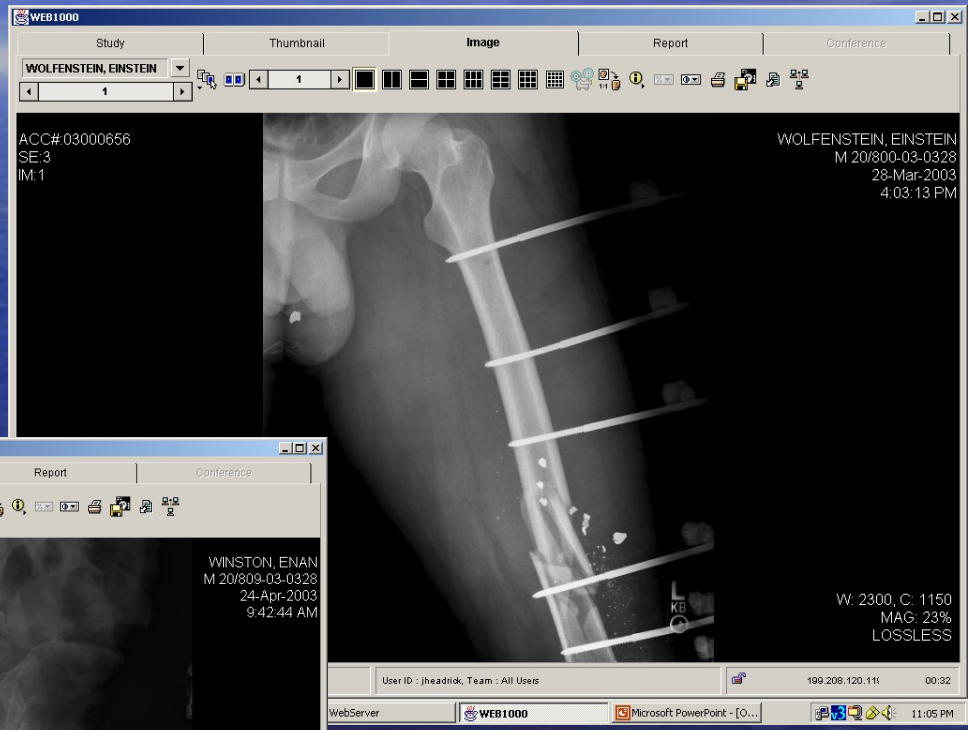
Operating Rooms

Recovery

Sent Home

TYPES OF INJURY

- Major Orthopedic injuries (Extremities)
- Serious Injuries
- High potential for infection



INJURIES

- High potential for wound infection
  - 55% GSW, 33% shrapnel, 26% blast, 14% blunt, 7% burns
- Invasive Procedures: Increase risk for infections
  - 20% orthopedic external fixator, 48% central line, 32% ETT tube, 38% NG tube, 63% Foley, 45% surgical drain and 4% TPN

Severe War Injury

External Fixators

Typical War Injury

Wound Care

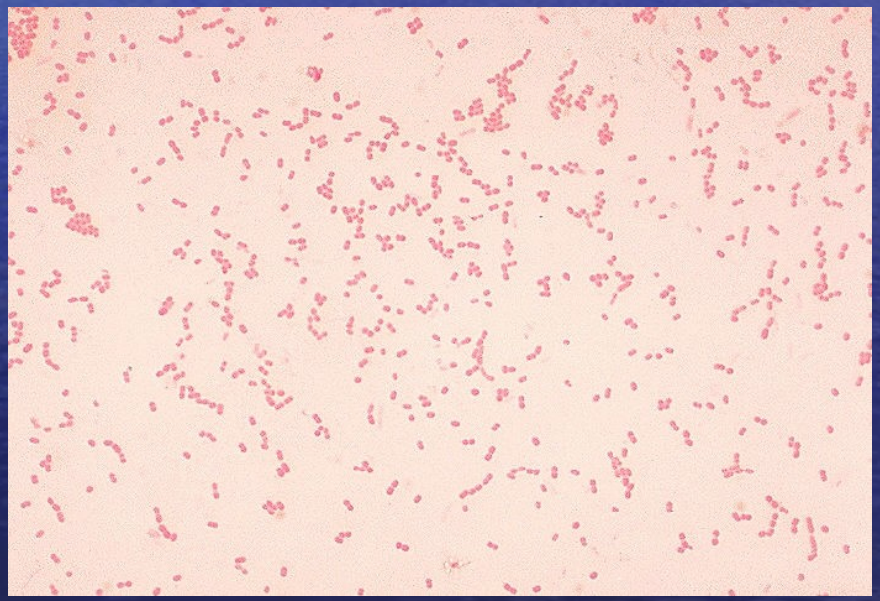
- Open or packed
  - Wound closed 7-14 days later (depending on severity)
- Invasive procedures
- External fixators
- Ideal for wound infections

Wound Infection Outbreak

- 2 deaths from sepsis
- Multi-drug Resistant (MDR) Acinetobacter
- Sensitive to Imipenem only!!
- Wounds susceptible

The Agent: Acinetobacter baumanii

- Non-motile gram negative coccobacillus
  - Often mistaken for staph
- *Acinetobacter baumanii* and *lwolffii* most commonly isolated in human disease
- Common Nosocomial pathogen
- Very difficult to eradicate on surfaces



Acinetobacter Source

- Initially cultured in ICU patients
- Iraqi prisoner with GSW abdomen
  - Overwhelming hypotension
  - Blood culture positive 48 hours later
  - Some difficulty Id’ing bug

HOW IS IT SPREAD

- Among people/healthcare providers having close contact with infected individuals
- Direct physical contact
- Indirect Contact (towels, sheets, lab coats, scrubs, clothes, beds)

Suspected Consecutive Cases

- Spread to other ICU Patients
  - Severe wound infection vulnerabilities
- Blood and wound cultures confirmed MDR *Acinetobacter*. Same Bug!

Clinical Implications

- Infection control issue
- 52 cases infected or colonized with MDR acinetobacter
- ¼ of all wounded seen on Comfort
- Theater-wide infection

Was this an Imported Infection?

- Community acquired
  - Environmental cultures on Comfort mostly negative
  - Easily Cultured from the soil in theater
    - Hospital-acquired infections following the 1999 Marmara earthquake*
      - Acinetobacter baumanii (31.2%) infection rate
    - D/W Dr Inglis Perth Australia, similar experience in Bali bombings
      - Tong JAMA 1972 46% *Acinetobacter* infection on hospital day #1 & 29% sepsis
- Literature supports our findings

*Oncul O J Hosp Infect. 2002 May;51(1):47-51

Nosocomial Spread

- Acinetobacter is very easily transmitted person to person and on surfaces
- Indirect Contact (Extra Attention Required)
- Initially Disposable Gowns not used

Infection Control Strategies

- Establish a surveillance/monitoring program
  - Monitor existing cases
  - Track location onboard ship
  - Identify new cases

Infection Control Strategies

- All patients were cultured
- New arrival were cultured
- Acinetobacter drug sensitivity ID’ed ASAP.

Infection Control Strategies

- Contact precautions
- Sanitize surfaces
- Proper disposal supplies and laundry
- More supplies required – Gloves, gowns
- Educate Staff

Infection Control Strategies

- Cohorting patients to achieve infection control
- Isolation*

Infection Control Strategies

- Monitoring: Environmental Swabs
  - Saline Bottles
  - Beds/Bed Frames*
  - Gurney
  - Curtains*

*Few positives

Continued Monitoring and Surveillance

- Must observe trends in incidence rates to control infections.
- Use what allows you to track and trend
- Identify Source or potential sources

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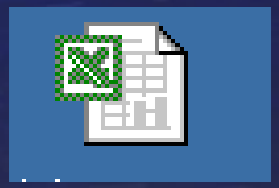
MS EXCEL



SPSS

Epi Info

Outbreak Controlled

- Culture, ID and Treat with Imipenem
- Cohorted
- Contact precautions

Important Components for Disease Control/Prevention

- Strong surveillance program
- Strong Infection Control Program
- Staff education awareness program
  - Looking for possible IC issues
- Collaboration with Preventive Medicine, Infectious Disease, Laboratory, Pharmacy

Future Work

- More military related shipboard infection Control research.
  - USNS Comfort/Mercy
  - Grey Hulls
- Better Understanding Modes of Transmission on ships
  - 1996-2000 - Gastroenteritis: 42% Food/water, 12% person to person, **46% Unknown**
  - 2002 Study – 21 outbreaks: 43% norovirus related, 14% bacteria, **43% Unknown**

Acknowledgements

- Dr. Kyle Petesen; Infectious Disease, National Naval Medical Center

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